HAZARD RANKING SYSTEM (HRS) PACKAGE
PIERSON'S CREEK
NEWARK, NEW JERSEY

CERCLIS ID No.: NJD002144517

EPA Contract No. EP-S5-06-04
TDD No. S05-0013-1111-015
Document Control No. 1673-2A-BDFA

December 2013
Revised: September 2014

Prepared for:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Prepared by:
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HRS DOCUMENTATION RECORD--REVIEW COVER SHEET

Name of Site: Pierson's Creek

Date Prepared: December 2013
Date Modified: September 2014

Contact Persons

Site Investigation: Ildefonso Acosta (212) 637-4344
U.S. Environmental Protection Agency
New York, NY

Documentation Record: Ildefonso Acosta (212) 637-4344
U.S. Environmental Protection Agency
New York, NY

Pathways, Components, or Threats Not Scored

The surface water migration pathway – drinking water threat, ground water migration pathway, soil exposure pathway, and air migration pathway were not scored because the listing decision is not affected significantly by those pathways. The site score is sufficient to list the site on the surface water migration pathway score based on the human food chain and environmental threats.

The ground water migration, soil exposure, and air migration pathways are adversely affected and are of potential concern, as the information in the HRS documentation record indicates. Soil and ground water contamination is widespread throughout the Troy property, and there was an air release from the facility in January 2011 that had an adverse effect on workers at the adjacent Federal Express facility.

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HRS DOCUMENTATION RECORD

Name of Site:	Pierson's Creek	Date Prepared: December 2013	
EPA ID No.:	NJD002144517	Date Modified: September 2014	
EPA Region:	2		
Street Address of Site*:	One Avenue L, Newark, NJ 07105		
County and State:	Essex County, New Jersey		
General Location in the State:	urban northeastern portion of State		
Topographic Maps:	Elizabeth, NJ-NY		
Latitude*:	40° 42′ 58.68" North (40.7163°)	Longitude*:	74° 08′ 42.72″ West (-74.1452°)
Site Reference Point:	concrete portion of Pierson's Creek, south edge of Troy Chemical property		

[Figures 1, 2; Ref. 3, p. 1; 4, p. 1; 5, p. 6]

** The street address, coordinates, and contaminant locations presented in this Hazard Ranking System (HRS) documentation record identify the general area where the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Scores

Ground Water Pathway	Not Scored
Surface Water Pathway	95.99
Soil Exposure Pathway	Not Scored
Air Pathway	Not Scored
HRS SITE SCORE	47.99

WORKSHEET FOR COMPUTING HRS SITE SCORE
PIERSON'S CREEK

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	Not Scored	
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	95.99	9,214.08
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	Not Scored	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	95.99	9,214.08
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	Not Scored	
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	Not Scored	
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$	9,214.08	
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root	47.99	

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
PIERSON'S CREEK

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors DRINKING WATER THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
1. Observed Release	550	550
2. Potential to Release by Overland Flow		
2a. Containment	10	not scored
2b. Runoff	25	not scored
2c. Distance to Surface Water	25	not scored
2d. Potential to Release by Overland Flow (lines 2a [2b + 2c])	500	not scored
3. Potential to Release by Flood		
3a. Containment (Flood)	10	not scored
3b. Flood Frequency	50	not scored
3c. Potential to Release by Flood (lines 3a x 3b)	500	not scored
4. Potential to Release (lines 2d + 3c)	500	not scored
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics		
6. Toxicity/Persistence	*	not scored
7. Hazardous Waste Quantity	*	not scored
8. Waste Characteristics	100	not scored
Targets		
9. Nearest Intake	50	not scored
10. Population		
10a. Level I Concentrations	**	not scored
10b. Level II Concentrations	**	not scored
10c. Potential Contamination	**	not scored
10d. Population (lines 10a + 10b + 10c)	**	not scored
11. Resources	5	not scored
12. Targets (lines 9 + 10d + 11)	**	not scored
13. DRINKING WATER THREAT SCORE ([lines 5 x 8 x 12]/82,500)	100	not scored

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
PIERSON'S CREEK

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors HUMAN FOOD CHAIN THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
14. Likelihood of Release (same as line 5)	550	550
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	*	5.00E+08
16. Hazardous Waste Quantity	*	100
17. Waste Characteristics	1,000	320
Targets		
18. Food Chain Individual	50	20
19. Population		
19a. Level I Concentrations	**	0
19b. Level II Concentrations	**	0
19c. Potential Human Food Chain Contamination	**	0.0000003
19d. Population (lines 19a + 19b + 19c)	**	0.0000003
20. Targets (lines 18 + 19d)	**	20.0000003
21. HUMAN FOOD CHAIN THREAT SCORE ([lines 14 x 17 x 20]/82,500)	100	42.66

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
PIERSON'S CREEK

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors ENVIRONMENTAL THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
22. Likelihood of Release (same as line 5)	550	550
Waste Characteristics		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	*	5.00E+08
24. Hazardous Waste Quantity	*	100
25. Waste Characteristics	1,000	320
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	**	0
26b. Level II Concentrations	**	25
26c. Potential Contamination	**	0.001
26d. Sensitive Environments (lines 26a + 26b + 26c)	**	25.001
27. Targets (line 26d)	**	25.001
28. ENVIRONMENTAL THREAT SCORE ([lines 22 x 25 x 27]/82,500)	60	53.33
29. WATERSHED SCORE (lines 13 + 21 + 28)	100	95.99
30. SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE (S_{of})	100	95.99
SURFACE WATER MIGRATION PATHWAY SCORE (S_{sw})	100	95.99

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

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6.	Gilliland, Gerald V., WESTON. Sampling Trip Report, Work Assignment No. 1673, Troy Chem Corp Inc. (Pierson's Creek), Contract No. EP-S5-06-04, TDD No. S05-0013-1111-015. November 9, 2012. [69 pages]
7.	Sheikh, Muhammad (Hanif), EPA. Email with attachments to Ildefonso Acosta et al, Subject: Regionally Assessed Inorganic Data for Troy Chemecal Corp Site --Case # 43052, SDG# MBAKW1. November 27, 2012. [79 pages]
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17.	New Jersey Department of Environmental Protection (NJDEP), Responsible Party Investigations Unit. Investigative Summary, Case name: Troy Chemical Corporation, Inc., AKA: Troy Chemical Company. June 1991. [80 pages]
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21.	Environmental Data Resources Inc. (EDR). Certified Sanborn® Map Report, Piersons Creek, 1 Avenue L, Newark, NJ, 07105; Inquiry Number 3263219.3. February 22, 2012. [23 pages]
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23.	Heacox, Illse, NJDEP. Memo to Assistant Commissioner Arbesman, Subject: Troy Chemical Pretreatment Issue. December 17, 1979. [2 pages]
24.	United States International Trade Commission (USITC; formerly United States Tarriff Commission). Synthetic Organic Chemicals, United States Production and Sales; excerpts from annual reports, 1956 to 1994. Various dates, 1957 to 1995. [508 pages]
25.	Lintner, William, L & L Chemical Construction and Engineering Co. Letter with enclosed permit application package to William B. Honachefsky, NJDEP, Subject: Permit to Locate, Pursuant to NJSA 58:10-17 to 21, inclusive, Troy Chemical Company, Newark City, Essex County. June 15, 1977. [9 pages]
26.	Shulfer, S., NJDEP. Memorandum to Robert Harrison, Subject: Permit to Locate inspection, Troy Chemical Corporation, City of Newark, Essex County. July 22, 1977. [5 pages]
27.	Honachefsky, William B., NJDEP. Letter to Milton Nowak, Troy Chemical Corporation, Re: Denial of Permit to Locate pursuant to N.J.S.A. 58:10-17 to 21; inclusive, Troy Chemical Corporation, City of Newark. July 22, 1977. [2 pages]

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31.	Maack, Charles L. and Charles L. Johnson, NJDEP. Memo to Edward H. Post, Subject: Inspection of Troy Chemical Corporation, Newark, NJ. December 21, 1979. [3 pages]
32.	Maack, C. and C. Johnson, NJDEP. Memo to File, Subject: Sampling Inspection, Troy Chemical Corporation, Newark. March 25, 1981. [9 pages]
33.	Johnson, Charles L., NJDEP. Memo to Charles L. Maack, Subject: Inspection of Troy Chemical Corporation, Newark. February 23, 1981. [2 pages]
34.	Gruzlovic, Mark S. through Bruce Comfort, NJDEP. Memo to Spill File, Subject: (07-14) #84-01-28-03C --- Unknown Liquid Discharge from Troy Chemical. May 3, 1984. [5 pages]
35.	Capasso, Edward J., Troy Chemical Corporation. Letter to Mr. Perrapato, Passaic Valley Sewerage Authority, Re: Sewer Permit #20403290. August 29, 1986. [2 pages]
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38.	The ELM Group, Inc. Remedial Investigation Report for Sediment and Surface Water, Troy Chemical Corporation Property, One Avenue L, Newark, Essex County, New Jersey, Case No. G000001344. Prepared for Troy Chemical Corporation. July 21, 2010. [356 pages]
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41.	Gevirtz, Arthur and John Ciancia, EPA. Memorandum to Dr. Richard Spear, Re: Site Inspection at the Former Albert Drum Co., Newark location on June 6, 1979. June 8, 1979. [3 pages]
42.	Morgan, James, Newark Fire Department. Memo to James P. O'Bierne, Re: Ave 'L' and Wilson Ave (Former Owner Albert Steel Drums). June 8, 1979. [1 page]

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Reference Number	Description of the Reference
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SITE DESCRIPTION

The Pierson's Creek site (EPA ID No. NJD002144517) is located at One Avenue L in Newark, Essex County, New Jersey [Ref. 3, p. 1; 4, p. 1; 21, p. 11]; the site location is shown in **Figure 1**. The site as scored consists of sediments in Pierson's Creek contaminated with mercury as a result of historical releases from the chemical manufacturing facility located at One Avenue L [see Sections 2.2 and 4.1.2.1.1]. The Troy Chemical facility, which remains active in the manufacture of antimicrobial and antifungal paint additives and related products, manufactured mercury compounds from 1956 or 1957 until 1987 [Ref. 17, p. 4, 22, 57; 18, p. 2; 19, pp. 12-14; 20, p. 14; 28, p. 2; 29, pp. 2-3, 6-7; 30, pp. 1-2; 37, p. 1; 38, pp. 13, 29-30]. Manufacturing processes at the facility included purification of mercury metal, production of mercuric oxide from the mercury metal, and the manufacture of organic mercury compounds using mercuric oxide [Ref. 17, p. 22; 18, p. 4; 19, p. 14; 20, pp. 14-15, 63; 30, p. 2]. The mercuric oxide manufacturing process was reported to be the primary source of mercury-bearing wastewater at the facility, accounting for approximately 7,000 gallons per week [Ref. 17, p. 22; 18, p. 4; 30, p. 2]. Other sources of mercury-bearing wastewater included spillage, leakage, and washing of equipment and floors in the mercuric oxide manufacturing operation; production of phenyl mercuric sulfide; and spills, leaks, and washings in all organic mercury compound manufacturing operations [Ref. 17, p. 22; 30, p. 2]. The Troy Chemical facility is shown in **Figure 2**.

The Troy Chemical facility discharged its mercury-bearing wastewater directly into Pierson's Creek without prior treatment until 1965, and after sulfide precipitation pretreatment from 1965 until 1976 [Ref. 17, pp. 6, 8; 18, p. 5; 30, p. 3]. Pierson's Creek historically flowed in the concrete channel that bisects the facility, and an unnamed, intermittent tributary flowed along the eastern property boundary and joined Pierson's Creek just south of the Troy facility [Ref. 17, pp. 1, 5, 7, 41; 19, pp. 3, 11, 64, 135; 22, pp. 9-14]. Due to a drainage improvement project completed in 2007, the perennial portion of Pierson's Creek now begins just south of the Troy Chemical facility, where it receives stormwater runoff from a large culvert as well as the concrete channel and east ditch on the Troy property [Ref. 5, p. 6; 38, pp. 14-23, 80]. Pierson's Creek flows from there through a series of open channels and culverts in a general south-southwesterly direction to the Port Newark Channel portion of Newark Bay [Figure 4; Ref. 5, pp. 6-8; 18, p. 69; 38, pp. 15-16].

In 1976, the Troy Chemical facility connected to the Passaic Valley Sewerage Commission (PVSC) sewer system, and began diverting wastewater from the mercury pretreatment system to an overall plant wastewater treatment plant (WWTP), where wastewaters were treated by settling, removal of suspended solids and oil, and neutralization before subsequent discharge to the PVSC system [Ref. 17, p. 22; 19, pp. 14-15]. Even these additional levels of treatment did not remove all mercury from the process wastewater – the mercury contribution to PVSC was calculated to be approximately 327 pounds per day tested in 1979; in another instance, the facility discharged an average of more than 30,000 gallons per day of mercury-bearing wastewater for a 91-day period in 1986 [Ref. 23, p. 1; 35, p. 1].

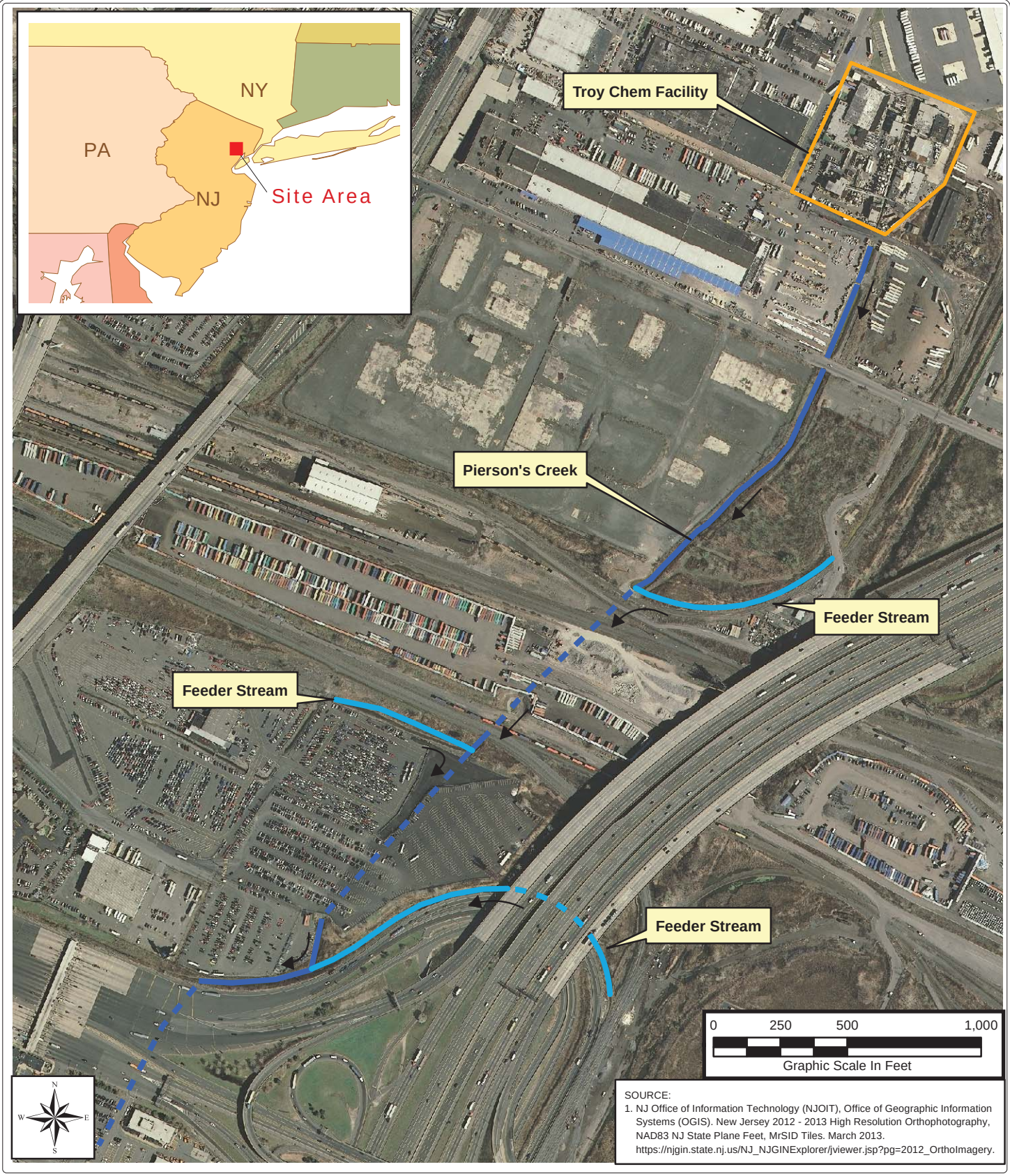
In addition to the facility wastewater discharges directed to Pierson's Creek, there are other reported instances of mercury-containing wastewater and stormwater discharging from the Troy facility into Pierson's Creek after connection to the PVSC sewer system [Ref. 18, pp. 5, 12-21]. An inspection in July 1977 revealed numerous pipes discharging into the stream, none of which were depicted on the site plan for the facility [Ref. 17, pp. 14-15]. During an inspection on April 28, 1980, New Jersey Department of Environmental Protection (NJDEP) observed stormwater and wastewater flowing into Pierson's Creek and its unnamed tributary via runoff, pipes, cracks in the creek's concrete walls adjacent to a Troy building and tank farm, and overflow from Troy's industrial wastewater collection sump [Ref. 32, pp. 1-2]. All of these liquids flowing into Pierson's Creek and its tributary were found to contain mercury, including one that contained mercury droplets; copper, lead, arsenic, and zinc were also detected [Ref. 32, pp. 1-9]. In January 1984, NJDEP observed cracks in a concrete wall of the creek and a pipe discharging into the creek [Ref. 34, p. 2]. In 1998, Troy Chemical considered surface water and sediment conditions in Pierson's Creek and its unnamed tributary to be the principal environmental concerns associated with the site [Ref. 19, p. 11].

Investigations by Troy Chemical, NJDEP, and EPA have indicated significant increases in sediment mercury concentrations at and downstream of the facility compared to upstream sediment concentrations, as recently as 2010 [Ref. 18, pp. 12-20; 19, p. 147; 30, pp. 4-9; 33, pp. 1-2; 37, p. 12; 38, p. 84; 39, pp. 29, 32]. In July 1979, EPA collected a sediment sample from Pierson's Creek just downstream of the mercury wastewater treatment system and reported a mercury concentration of 22,400 milligrams per kilogram (mg/kg), compared to upstream concentrations of 140 and 191 mg/kg; EPA also reported mercury concentrations above background for samples collected downstream of the facility [Ref. 30, pp. 4-7]. The same report indicates a significant increase in water concentrations for benzene, which was a raw material at the Troy Chemical facility [Ref. 30, pp. 6-8].

EPA conducted an investigation of Pierson's Creek in October 2012, which confirmed the observed release of mercury to the creek sediments. Mercury was detected in sediment samples collected throughout the accessible portions of the creek, and a site-attributable observed release is documented for a distance of approximately 0.25 mile downstream of the Troy facility [see Section 4.1.2.1.1]. The affected area includes 0.15 mile of wetland frontage [Figure 3; Ref. 1, Section 4.1.4.3.1; Ref. 5, pp. 43-62]. The zone of contamination and the wetland frontage are shown in **Figure 3**.

Pierson's Creek flows through a series of open channels and culverts to Newark Bay approximately 1.5 miles downstream of the Troy Chemical facility [Figures 3, 4; Ref. 5, pp. 6-8; 18, p. 69; 38, pp. 15-16]. There are downstream areas within the target distance limit (TDL) where fish are caught and consumed, and Newark Bay is part of the New York-New Jersey Harbor Estuary, a sensitive area identified under the National Estuary Program [Figure 4; Ref. 48, p. 2; 51, pp. 1-10; 53, pp. 29-30; 54, pp. 15, 22, 29; 55, p. 1].

For the Pierson's Creek site, EPA is evaluating the human food chain and environmental threats of the surface water migration pathway, overland/flood migration component [Ref. 1, Sections 4.1.3 and 4.1.4]. The source under consideration is the collective historical discharge of mercury wastewater from the Troy Chemical manufacturing facility (Source 1). Laboratory analytical results for sediment samples collected by EPA in October 2012 confirmed the observed release of mercury to the creek downstream of the Troy Chemical facility; the zone of contamination is partially bordered by wetlands [Figure 3; see Sections 4.1.2.1.1 and 4.1.4.3.1.2].



SOURCE:
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LEGEND:

Pierson's Creek
Feeder Streams
(Unnamed Tributaries)
Flow Direction
Facility Boundary

TITLE:

Location Map
Pierson's Creek
Newark, Essex County, NJ

PROJECT:
Pierson's Creek

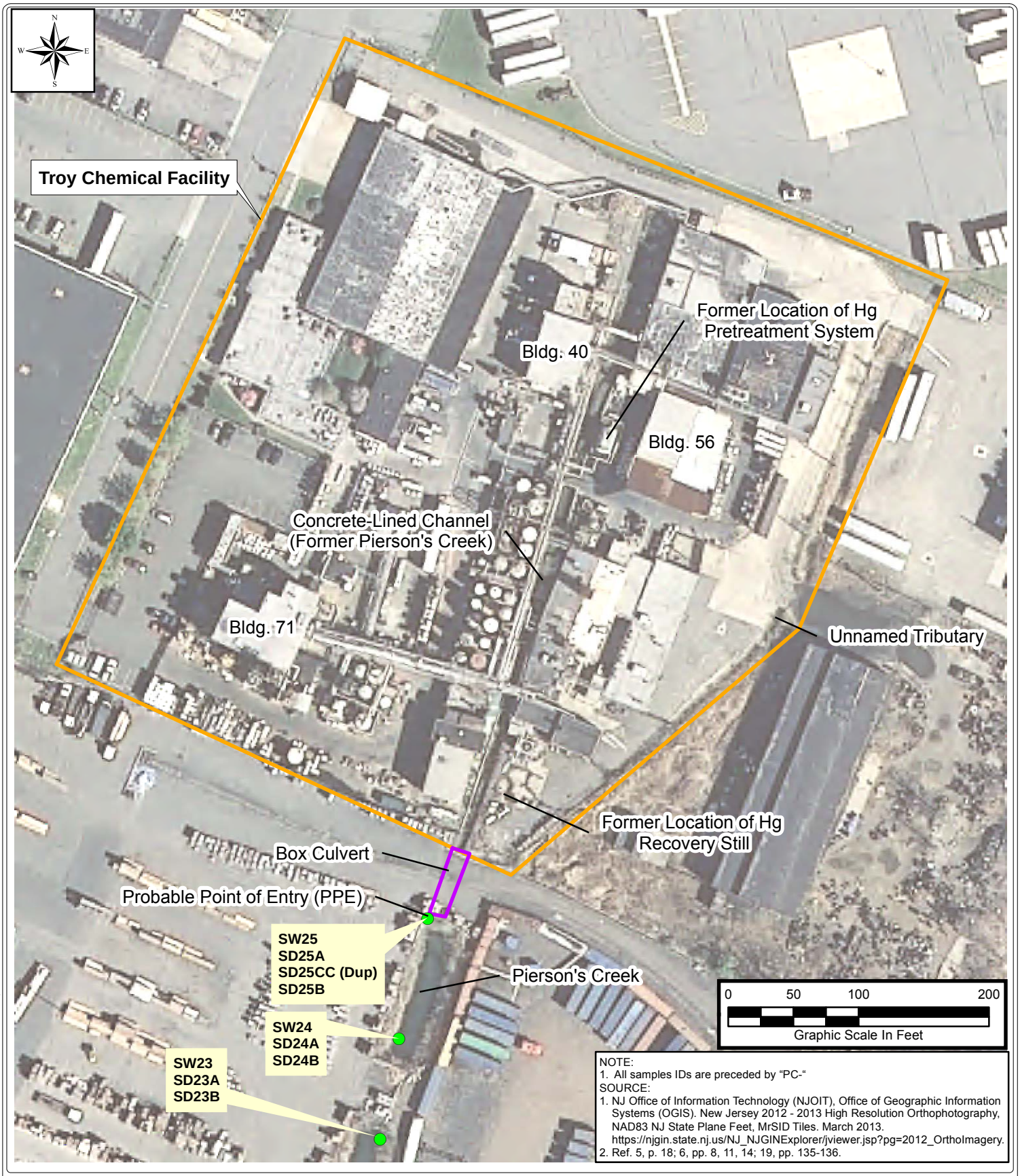
CLIENT NAME:
EPA

WESTON SOLUTIONS

DATE:
August 2013
September 2014

FIGURE #:
1

P:\SAT2\Piersons Creek\MXD\2013_08_HRS\13534_TCC_Site_Loc_201308.mxd



NOTE:
1. All samples IDs are preceded by "PC-"

SOURCE:
1. NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). New Jersey 2012 - 2013 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles. March 2013. https://njgin.state.nj.us/NJ_NJGINExplorer/jviewer.jsp?pg=2012_OrthoImagery.
2. Ref. 5, p. 18; 6, pp. 8, 11, 14; 19, pp. 135-136.

LEGEND:
- Sample Location
- Facility Boundary

TITLE:

Historical Facility Map
Pierson's Creek
Newark, Essex County, NJ

PROJECT: Pierson's Creek

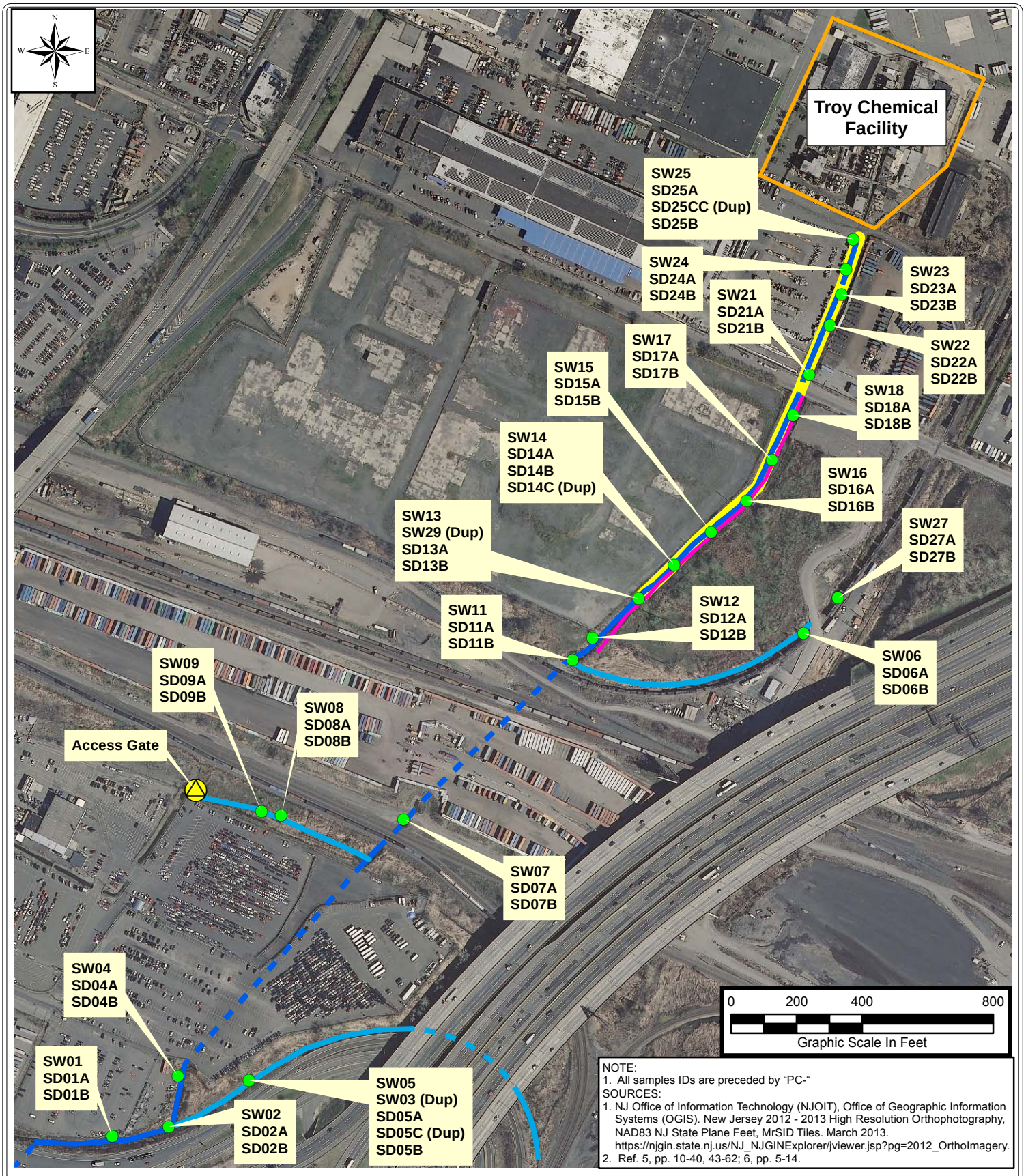
CLIENT NAME: EPA

WESTON SOLUTIONS

DATE: August 2013
September 2014

FIGURE #: 2

P:\SAT2\Piersons Creek\MXD\2013_08_HRS\13585_TCC_Historic_Facility.mxd



NOTE:
1. All samples IDs are preceded by "PC-"

SOURCES:
1. NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). New Jersey 2012 - 2013 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles. March 2013. https://njgin.state.nj.us/NJ_NJGINExplorer/jviewer.jsp?pg=2012_OrthoImagery.
2. Ref. 5, pp. 10-40, 43-62; 6, pp. 5-14.

LEGEND:
- Sample Location
- Access Gate
- Zone of Contamination
- Wetland Frontage
- Pierson's Creek Feeder Streams (Unnamed Tributaries)
- Facility Boundary

TITLE:

Surface Water Pathway Zone of Contamination
Pierson's Creek
Newark, Essex County, NJ

PROJECT: Pierson's Creek

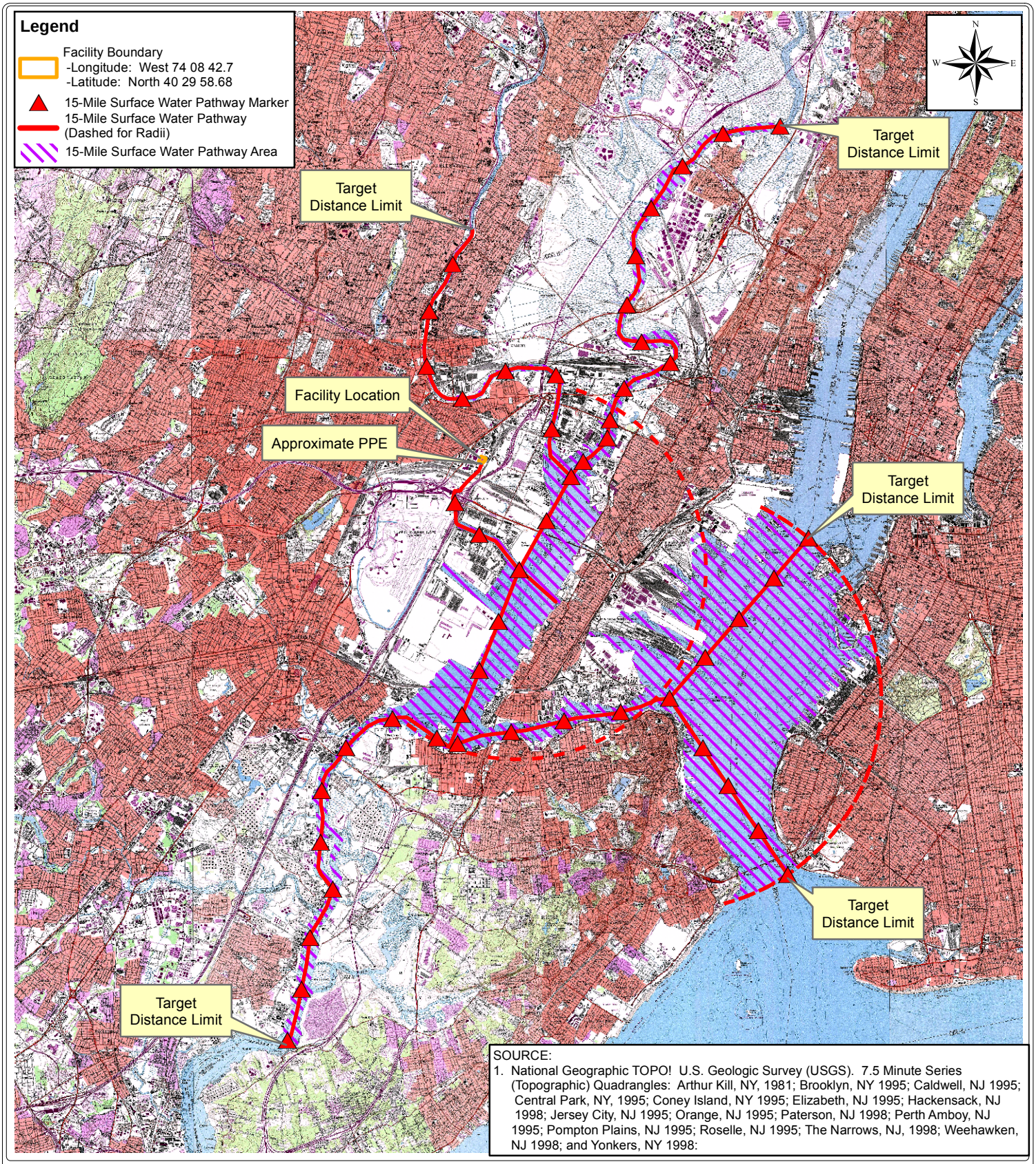
CLIENT NAME: EPA

WESTON SOLUTIONS

DATE: August 2013
September 2014

FIGURE #: 3

P:\SAT2\Piersons Creek\MXD\2013_08_HRS\13536_TCC_SW_Zone_Contamination_201308.mxd



SOURCE:
1. National Geographic TOPO! U.S. Geologic Survey (USGS). 7.5 Minute Series (Topographic) Quadrangles: Arthur Kill, NY, 1981; Brooklyn, NY 1995; Caldwell, NJ 1995; Central Park, NY, 1995; Coney Island, NY 1995; Elizabeth, NJ 1995; Hackensack, NJ 1998; Jersey City, NJ 1995; Orange, NJ 1995; Paterson, NJ 1998; Perth Amboy, NJ 1995; Pompton Plains, NJ 1995; Roselle, NJ 1995; The Narrows, NJ, 1998; Weehawken, NJ 1998; and Yonkers, NY 1998:

LEGEND:

2.5 1.25 0 2.5

Graphic Scale In Miles

TITLE:

Surface Water Migration Pathway Map
Pierson's Creek
Newark, Essex County, NJ

PROJECT: Pierson'sCreek

CLIENT NAME: EPA

WESTON SOLUTIONS

DATE: August 2013
September 2014

FIGURE #: 4

P:\SAT2\Piersons Creek\MXD\2013_08_HRS\13535_TCC_Sample_Loc_201308.mxd

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of the source: Source No. 1

Name and description of the source: Historical Wastewater Discharge – Troy Chemical facility

Source Type: Other

Source 1 consists of the historical discharge of mercury-bearing wastewater from the Troy Chemical facility into Pierson's Creek. The facility initiated manufacture of mercury-containing products in 1956 or 1957 [Ref. 17, pp. 4, 22; 19, p. 14; 20, p. 14; 28, p. 2; 30, p. 1]. Organic mercury compounds produced at the facility included phenylmercuric acetate (PMA), phenylmercuric oleates, phenylmercuric ammonium acetate, chloromethoxypropylmercuric acetate, phenylmercuric borate, diphenylmercury dodecenylsuccinate, phenylmercuric hydroxide, phenylmercuric lactate, and phenylmercuric sulfide [Ref. 24, pp. 79-80, 86, 90-92, 95, 99-101, 106, 111-112, 117, 122-123, 127, 131-133, 136, 141-142, 146, 150-153, 157, 161-164, 167, 171-174, 179, 183-184, 187, 194, 198-199, 202, 208, 212-213, 221, 225-226, 234, 238-239, 247, 252-253, 258, 264, 269-270, 279, 284-285, 294, 300-301, 310, 316-317, 319, 333-334, 344, 349, 358, 363, 372, 377-378, 387, 392-393, 401, 405-406, 413, 417, 425; 30, p. 2]. Manufacturing processes included purification of mercury metal, production of mercuric oxide from the mercury metal, and production of the organic mercury compounds using the mercuric oxide [Ref. 17, p. 22; 18, p. 4; 19, p. 14; 20, pp. 14-15, 63; 30, p. 2].

The mercuric oxide manufacturing process was reported to be the primary source of mercury-bearing wastewater at the facility, accounting for approximately 7,000 gallons per week [Ref. 17, p. 22; 18, p. 4; 30, p. 2]. Spillage, leakage, and washing of equipment and floors contributed additional mercury-bearing wastewater from the mercuric oxide manufacturing operation [Ref. 17, p. 22; 30, p. 2]. The mercuric oxide manufacturing process took place near Building 56 (constructed prior to 1954 on the east side of Pierson's Creek) until 1971, when the process was moved across the creek to Building 40 [Ref. 19, pp. 14, 135; 20, pp. 15, 49, 63]. In the organic mercury compound manufacturing operations, the main source of discharged mercury-containing wastewater was the production of phenylmercuric sulfide [Ref. 17, p. 22; 30, p. 2]. Spills, leaks, and washings in all organic mercury compound manufacturing operations contributed additional mercury-bearing wastewater [Ref. 30, p. 2]. Until 1976, Building 91 (constructed prior to 1954 along the east bank of Pierson's Creek) was the manufacturing portion of the chemical facility [Ref. 19, pp. 14, 135]. In June 1976, fungicide manufacturing began in Building 71, construction of which began in the western portion of the facility in 1975 [Ref. 19, pp. 15, 135; 25, p. 5]. In a June 1977 permit application for the fungicide plant, Troy Chemical indicated that the plant was generating 2,962-2,963 gallons per day of industrial wastewater [Ref. 25, pp. 1-6; 26, p. 1]. The locations of Buildings 56, 40, and 71 are shown in **Figure 2**.

The Troy Chemical facility discharged its mercury-bearing wastewaters directly to Pierson's Creek without treatment until 1965, when the facility's mercury pretreatment system was installed west of Building 56 at the edge of the creek [Ref. 17, p. 6; 18, p. 5; 20, pp. 14-16, 49, 63; 30, p. 3]. From 1965 to 1976, the mercury-bearing wastewaters were discharged to Pierson's Creek after a sulfide precipitation process in the pretreatment system [Ref. 17, pp. 6, 8; 18, p. 5; 19, pp. 13-14]. In 1976, the facility connected to the PVSC sewer system, and began diverting wastewater from the mercury pretreatment system to the facility WWTP, where wastewaters were treated by settling, removal of suspended solids and oil, and neutralization before subsequent discharge to the PVSC system [Ref. 17, p. 22; 19, pp. 14-15]. Even these additional levels of treatment at the WWTP did not remove all mercury from the process wastewater – the mercury contribution to PVSC was calculated to be approximately 327 pounds per day tested in 1979, and the facility discharged an average of more than 30,000 gallons per day of mercury-bearing wastewater to the PVSC sewer system for a 91-day period in 1986 [Ref. 23, p. 1; 35, p. 1]. The facility reported that it ceased the manufacture of mercury-containing products that discharged to the sewer effluent as of February 1, 1987 [Ref. 36, p. 1].

In addition to the facility wastewater discharges directed to Pierson's Creek, there are other reported instances of mercury-containing wastewater and stormwater discharging from the Troy facility into Pierson's Creek after connection to the PVSC sewer system [Ref. 18, pp. 5, 12-21]. An inspection in July 1977 revealed numerous pipes discharging into the stream, none of which were depicted on the site plan [Ref. 17, pp. 14-15]. During an inspection on April 28, 1980, NJDEP reported the observance of stormwater and wastewater flowing into Pierson's Creek and its unnamed tributary via runoff, pipes, cracks in the creek's concrete walls adjacent to a Troy building and tank farm, and overflow from Troy's industrial wastewater collection sump [Ref. 32, pp. 1-2]. All of these liquids flowing into Pierson's Creek and its tributary were found to contain mercury, including one that contained mercury droplets; copper, lead, arsenic, and zinc were also detected [Ref. 32, pp. 1-9]. In January 1984, NJDEP observed cracks in the concrete wall of the creek and a pipe discharging into the creek [Ref. 34, p. 2].

Location of the source, with reference to a map of the site:

The direct discharges to Pierson's Creek occurred in the concrete channel (formerly Pierson's Creek) that bisects the Troy Chemical facility [Ref. 19, pp. 135-136]. The location is shown in **Figure 2**.

Containment

Release to surface water via overland migration and/or flood:

The Troy facility discharged untreated mercury wastewater directly to Pierson's Creek until 1965, and partially treated mercury wastewater directly to the creek from 1965 until 1976 [Ref. 18, pp. 4-5; 30, pp. 2-3]. The October 2012 EPA investigation confirmed that mercury has migrated from the source; analytical results for sediment samples downstream of the historical releases indicate the presence of mercury [see Section 4.1.2.1]. Based on the historical lack of containment and the current evidence of overland hazardous substance migration from the source, a surface water containment factor value of 10 is assigned for this source [Ref. 1, p. Table 4-2].

2.2.2 Hazardous Substances

The Troy Chemical facility discharged treated mercury-bearing wastewaters into Pierson's Creek from 1965 until 1976 [Ref. 17, pp. 6, 8; 18, p. 5; 19, pp. 13-14; 20, pp. 14-16, 49, 63; 30, p. 3]. In addition, there are other reported instances of mercury-containing wastewater and stormwater discharging from the Troy Chemical facility into Pierson's Creek after connection to the PVSC sewer system [Ref. 18, pp. 5, 12-21]. During an inspection on April 28, 1980, NJDEP reported the observance of stormwater and wastewater flowing into Pierson's Creek and its unnamed tributary via runoff, pipes, cracks in the creek's concrete walls adjacent to a Troy building and tank farm, and overflow from Troy's industrial wastewater collection sump [Ref. 32, pp. 1-2]. All of these liquids flowing into Pierson's Creek and its tributary were found to contain mercury, including one that contained mercury droplets; copper, lead, arsenic, and zinc were also detected [Ref. 32, pp. 1-9].

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The hazardous constituent quantity for Source 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence [Ref. 1, Section 2.4.2.1.1]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 1 with reasonable confidence, and hazardous constituent quantity is not scored (NS).

Hazardous Constituent Quantity (C) Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity

The Troy Chemical facility initiated manufacture of mercury-containing products in 1957, and the facility discharged its mercury-bearing wastewaters directly into Pierson's Creek until 1976 [Ref. 17, pp. 4, 6, 8, 22; 18, p. 5; 28, p. 2; 30, pp. 1-3]. The mercuric oxide manufacturing process was reported to be the primary source of mercury-bearing wastewater at the facility, accounting for approximately 7,000 gallons per week [Ref. 17, p. 22; 18, p. 4; 30, p. 2]. Other sources that contributed additional, undisclosed quantities of mercury-bearing wastewater at the facility included spillage, leakage, and washing of equipment and floors in the mercuric oxide manufacturing operation; production of phenyl mercuric sulfide; and spills, leaks, and washings in all organic mercury compound manufacturing operations [Ref. 17, p. 22; 30, p. 2].

In addition to the facility wastewater discharges directed to Pierson's Creek, there are other reported instances of mercury-containing wastewater and stormwater discharging from the Troy Chemical facility into Pierson's Creek after connection to the PVSC sewer system in 1976 [Ref. 18, pp. 5, 12-21]. An inspection in July 1977 revealed numerous pipes discharging into the stream, none of which were depicted on the site plan for the facility [Ref. 17, pp. 14-15]. During an inspection on April 28, 1980, NJDEP reported the observance of stormwater and wastewater flowing into Pierson's Creek and its unnamed tributary via runoff, pipes, cracks in the creek's concrete walls adjacent to a Troy building and tank farm, and overflow from Troy's industrial wastewater collection sump [Ref. 32, pp. 1-2]. All of these liquids flowing into Pierson's Creek and its tributary were found to contain mercury, including one that contained mercury droplets; copper, lead, arsenic, and zinc were also detected [Ref. 32, pp. 1-9].

Based on this information, 7,000 gallons per week during the period when Troy Chemical discharged its mercury-containing wastewater into Pierson's Creek (1957-1976) is considered a minimum estimate of hazardous wastestream quantity for Source 1. While discharges containing mercury are documented to have occurred from the Troy Chemical facility during this time period, the documentation contains some uncertainty on the actual quantity of mercury-bearing wastewater discharged. Therefore, the hazardous wastestream quantity value has been assigned a value of undetermined, but greater than zero [Ref. 1, Section 2.4.2.1].

Hazardous Wastestream Quantity Value: Undetermined, but greater than zero

2.4.2.1.3 Volume

There are insufficient historical and current data available to adequately determine the Tier C volume measure with reasonable confidence [Reference 1, Section 2.4.2.1.3].

Volume (V) Assigned Value: 0

2.4.2.1.4 Area

The Tier D area measure is not evaluated for source type "other."[Reference 1, Section 2.4.2.1.4, Table 2-5].

Area (A) Assigned Value: 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value for Source 1 is undetermined, but greater than zero for Tier B – Hazardous Wastestream Quantity [Ref. 1, Section 2.4.2].

Source Hazardous Waste Quantity Value: Undetermined, but greater than zero

SITE SUMMARY OF SOURCE DESCRIPTIONS

TABLE 1. HAZARDOUS WASTE QUANTITY AND CONTAINMENT					
Source Number	**Source Hazardous Waste Quantity Value**	**Containment**			
		Ground Water	**Surface Water**	**Air**	
				Gas	**Particulate**
1	>0	NS	10	NS	NS

NS = Not Scored

Other Possible Sources and Areas of Concern

Discarded Troysan phenylmercury acetate: In May 1979, investigators from the City of Newark, the U.S. Attorney's office, and EPA discovered grayish powder dumped on the ground throughout the 338 Wilson Avenue property north of the Troy facility, including alongside and within the Pierson's Creek streambed [Ref. 40, pp. 1-4; 41, pp. 1-3; 42, p. 1; 43, pp. 4, 24]. The property was also littered with open bags labeled "Troysan", and the analysis indicated that the mercury content of the product (PMA, or mercury acetate) was 12% [Ref. 40, pp. 1-4; 41, p. 1]. Troysan was a trade name used by Troy Chemical Corp. for many of the products manufactured at the facility, including PMA [Ref. 17, p. 74]. A laboratory analysis of the grayish powder that had been dumped on the ground indicated that it contained 0.5% mercury [Ref. 40, pp. 1, 4]. The discarded bags and grayish powder were located on the 338 Wilson Avenue property north of the current Troy facility, which is the address that Troy reported as its facility address from 1961 until 1969 [Ref. 24, pp. 85, 92, 101, 110, 119, 126, 136, 146, 156; 43, pp. 4, 24]. That is also the property address for the Albert Steel Drum/Prentiss Drug & Chemical (ASD/PDC) site [Ref. 43, pp. 4-5; 59, pp. 1], which is discussed further in Section 4.1.2.1.

Other areas of concern: Investigations completed by Troy Chemical and by regulatory agencies have identified several other areas of concern related to mercury and other hazardous substances, including benzene; areas of concern include the former mercury recovery still (also referred to as the mercury reclamation process area), located along Pierson's Creek in the southeastern corner of the facility and operational in the 1970s; the vicinity of the former mercury treatment system to the west of Building 56; the former septic tank on the eastern side of the site; and contaminated soil associated with mercury-related and other operations at several buildings [Ref. 20, pp. 16-21, 30-36; 26, p. 2; 37, pp. 1-2]. In July 1977, the facility's Plant Engineer informed NJDEP that the old septic system, which was not on the site plan provided by Troy and was being used illegally at the time, had been dye tested and was found to leach into the stream; the NJDEP inspectors confirmed the condition with their own dye test [Ref. 26, p. 2; 27, pp. 1-2]. NJDEP also observed drum storage areas without secondary containment and leakage of waste material from drums to the ground [Ref. 26, pp. 2, 4-5]. During an inspection of the facility in December 1979, NJDEP observed mercury droplets on the concrete pad and all areas surrounding the mercury recovery still, and "a lot of mercury" on the floor and outside concrete pad of Building 40 [Ref. 17, pp. 25-26; 31, pp. 1-2]. In January 1984, NJDEP observed flammable brown liquid coming out of the Troy Chemical property via Pierson's Creek, and observed spillage of red-brown liquid within the Troy Chemical plant [Ref. 34, pp. 1-4].

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

Pierson's Creek is an approximately 1.5-mile, man-made ditch located in a heavily industrialized section of Newark [Figure 4; Ref. 5, pp. 6-8; 18, p. 69; 38, pp. 15-16; 48, p. 2]. For more than 100 years, the creek has been used as an urban stormwater drainage structure and it continues to be a component of the City of Newark's stormwater management system [Ref. 38, p. 15]. Historically, including at the time of mercury releases, Pierson's Creek surfaced from a 36-inch stormwater culvert on the adjacent property to the north of Troy Chemical and flowed in the concrete channel that bisects the Troy facility; an unnamed, intermittent tributary flowed along the eastern property boundary and joined Pierson's Creek just south of the facility [Ref. 17, pp. 1, 5, 7, 41; 19, pp. 3, 11, 64, 135; 22, pp. 9-14; 38, pp. 15-16; 39, p. 29; 43, pp. 20-21; 45, pp. 9, 12]. Due to a drainage improvement project completed in 2007 (* - see Note below), the perennial portion of Pierson's Creek now begins just south of the Troy Chemical facility, where it receives stormwater runoff from a large culvert as well as the concrete channel and east ditch on the Troy property [Ref. 5, p. 6; 38, pp. 14-21, 80]. The probable point of entry (PPE) to surface water is this point just south of the Troy Chemical facility, as shown in **Figure 2**.

Pierson's Creek flows from the PPE through a series of open channels and culverts in a general south-southwesterly direction for approximately 1.5 miles to the Port Newark Channel portion of Newark Bay [Figure 4; Ref. 5, pp. 6-8; 18, p. 69; 38, pp. 15-16; 48, p. 2]. Port Newark Channel is listed as the receiving waters for Troy's 1978 National Pollutant Discharge Elimination System (NPDES) permit [Ref. 29, p. 1]. During the October 2012 sampling event, Pierson's Creek showed signs of tidal influence from the bay, including water-level fluctuations and flow reversal [Ref. 5, pp. 19-40]. Troy Chemical has reported that salinity measurements collected in March 2005 showed tidal influence only near its discharge point to Newark Bay [Ref. 38, pp. 15]. Moving north to south, the creek flows through the Former Red Star property (currently occupied by Continental Hardware); the vacant, former Engelhard property; Conrail's Oak Island rail yard; and private parking lots built on a former landfill within the Port of Newark [Ref. 5, pp. 4-8; 38, pp. 15-16]. The creek flows through these properties for approximately 1 mile before being routed through culverts beneath Interstate 78, Newark International Airport, and New Jersey Turnpike [Figures 3, 4; Ref. 18, p. 69; 38, pp. 15-16].

Newark Bay is part of the New York-New Jersey Harbor Estuary, which also includes Upper New York Bay, Lower New York Bay, and Raritan Bay; the channels that connect the bays, including Arthur Kill/Pratt Creek, Kill Van Kull, and The Narrows; and the tidal portions of the Hackensack River, Passaic River, and other rivers [Ref. 48, pp. 1-2; 50, pp. 1-10, 14]. The surface water migration pathway for the Pierson's Creek site extends throughout the coastal tidal waters of Newark Bay, Arthur Kill, Kill Van Kull, Upper New York Bay, The Narrows, and into Lower New York Bay, in a series of arcs through the bays and lines through the channels [Figure 4; Ref. 1, Section 4.1.1.1; 48, p. 2]. In addition, the lower reaches of the Passaic and Hackensack Rivers are included within the target distance limit (TDL) because they are classified as saline estuarine waters, indicating that the tidal run could carry hazardous substances to upstream targets [Ref. 1, Section 4.1.1.2; 58, pp. 44, 80-85]. Due to the complexity of the estuary and the presence of large landmasses, there are multiple TDLs for the Pierson's Creek site, as shown in **Figure 4** [Ref. 48, p. 2].

* Note: Until 2007, the northern (upper) reach of Pierson's Creek emanated from the 36-inch box culvert, which received stormwater from Newark's Ironbound District; stormwater from adjacent industrial facilities, including Troy Chemical, drained directly to the creek via overland flow and stormwater management structures [Ref. 38, pp. 15-17]. In 2007, the City of Newark rerouted the stormwater drainage system to bypass the upper reach of Pierson's Creek (i.e., FedEx and Troy Chemical) [Ref. 38, pp. 15-17]. The new configuration of stormwater drainage consists of a box culvert near the intersection of Avenue L and Wilson Avenue, which receives stormwater from the surrounding neighborhoods and routes it through a culvert that flows south under Avenue L and turns east at the southern end of Avenue L [Ref. 5, pp. 6, 8]. The culvert discharges to the open portion of Pierson's Creek just south of the Troy Chemical facility [Ref. 5, pp. 6, 8]. The former northernmost reach of the creek has been buried beneath the Federal Express parking lot, as shown in **Figure 2**.

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

An observed release to surface water is documented by direct observation and chemical analysis.

Direct Observation

Observed release by direct observation is supported by numerous reports of mercury-containing wastewater and stormwater discharging from the Troy facility directly into Pierson's Creek and its unnamed tributary [Ref. 18, pp. 5, 12-21]. On March 25, 1977, NJDEP issued Troy Chemical a Notice of Violation and Offer of Settlement (NOV/OOS) indicating that waste chemicals were allowed to enter a tributary to Newark Bay; Troy settled the NOV/OOS as stipulated [Ref. 17, p. 11]. During an inspection on April 28, 1980, NJDEP observed stormwater and wastewater flowing into Pierson's Creek and the unnamed tributary via runoff, pipes, cracks in the creek's concrete walls adjacent to a Troy building and tank farm, and overflow from Troy's industrial wastewater collection sump [Ref. 32, pp. 1-2]. NJDEP collected and analyzed samples C27080 (Stormwater runoff sample, flowing into a tributary of Pierson's Creek directly east of tank farm A), C27091 (Liquid sample, containing mercury droplets, collected at the same location as sample No. C27080), C27081 (Stormwater pipe flowing into Pierson's Creek), C27082 (Groundwater/stormwater sample flowing into Pierson's Creek through a crack in the Creek wall adjacent to Troy's Blue building), C27083 (Overflow from Troy's industrial wastewater collection sump; discharge was on the east side of Pierson's Creek approximately 50 feet downstream from the [old] locker room discharge), C27084 (Groundwater/stormwater sample flowing into Pierson's Creek through a crack in the creek wall adjacent to Troy's tank farm E), and C27085 (Stormwater flowing into Pierson's Creek on the south side of Troy's maintenance building) [Ref. 32, pp. 1-9]. The laboratory analyses indicated the presence of mercury in all of these wastestreams observed flowing into Pierson's Creek and its tributary; copper, lead, arsenic, and zinc were also detected in multiple samples [Ref. 32, pp. 3-9].

The observed release to surface water is also supported by the EPA investigation results, as described below.

Chemical Analysis

In October 2012, EPA collected surface water and sediment samples for TAL metals and TCL organics analysis from the open-water segments of Pierson's Creek along the in-water segment of the surface water migration pathway downstream of the Troy facility site source, and at background locations along unnamed tributaries (i.e., feeder streams) [Figure 3; Ref. 5, pp. 9-18; 6, pp. 3-14]. The sampling and analysis by EPA showed the presence of mercury at concentrations significantly above background concentrations in sediment samples collected along the downstream in-water segment of the surface water pathway [Figures 3, 4; see Tables below]. The observed release by chemical analysis is documented along the surface water migration pathway downstream of the site source, between the sample PC-SD25B at the PPE and sample PC-SD13B, approximately 0.25 mile downstream [Figure 3].

Notes on Sample Similarity:

Release samples were collected along the surface water migration pathway downstream of the Troy facility; background samples were collected from feeder streams believed to be unaffected by site sources due to not being downstream [Figure 3]. The background and release samples were handled the same procedurally and were similar physically, as follows:

- Sampling Methods: The background and release sediment samples were all collected by EPA during the same sampling event in October 2012 [Figure 3; Ref. 5, pp. 9-18; 6, pp. 3-14]. Sediment samples were collected within the 0- to 6-inch and 12- to 18-inch depth intervals with decontaminated augers, and the samples were homogenized in dedicated, disposable aluminum trays with dedicated, disposable plastic scoops [Ref. 5, pp. 9-18, 22, 24-25, 28-31, 34, 38, 40; 6, pp. 5-11]. The sampling team maintained custody of the samples until shipping to the laboratory, and the samples were received by the laboratory intact and under custody [Ref. 6, pp. 3-6, 15-69].

- Analytical Procedures: The background and release sediment samples were analyzed for TAL metals including mercury by Test America Laboratories, Inc. according to the Contract Laboratory Program (CLP) Statement of Work (SOW) [Ref. 7, pp. 2-5; 8, pp. 2-5; 9, pp. 2-6; 10, pp. 2-5]. Reporting detection limits (RDL) for the results represent the increase over Quantitation Limits based on factors such as sample characteristics and dilution to enable quantification of target analytes [Ref. 7, pp. 71-76; 8, pp. 76-82; 9, pp. 75-80; 10, pp. 58-61]. Therefore, the RDL for each result is considered to equate to sample quantitation limit (SQL), which is defined in the HRS as the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (for example, dilution, concentration) [Ref. 1, Sections 1.1 and 2.3].
- Sampling Depth: Background and release sediment samples were collected from the 0- to 6-inch or 12- to 18-inch depth intervals within the Pierson's Creek or unnamed tributary streambed, with the exception of sample PC-SD17B collected from the 12- to 14-inch depth interval; water depth at the sample locations ranged from 4 to 24 inches [Ref. 5, pp. 9-18, 22, 24-25, 28-31, 34, 38, 40; 6, pp. 5-11].
- Percent Solids: The Test America laboratory measured the percent solids of each sediment sample. Percent solids in the background samples ranged from 33.3% to 75.0%, and percent solids in the release samples ranged from 31.1% to 60.5% [Ref. 7, pp. 2, 5, 26, 28, 30, 35, 37, 40, 42; 8, pp. 2, 5, 9, 12, 29, 30, 32, 34; 9, pp. 2, 5, 10, 13, 24; 10, pp. 2, 5, 16, 19, 27].
- Total Organic Carbon: The sediment samples were analyzed by the EPA Region 2 Laboratory for total organic carbon (TOC) according to method EPA 415.1mod / SOP C-88 [Ref. 11, pp. 3-5]. TOC levels in the background samples ranged from 18,000 mg/kg to 130,000 mg/kg, while TOC levels in the release samples ranged from 15,000 mg/kg to 120,000 mg/kg [Ref. 11, pp. 8-9, 11-13, 15-16, 19-20, 22-25, 28].
- Grain Size: The sediment samples were analyzed by the EPA Region 2 Laboratory for grain-size distribution according to method ASTM D422-63 / BIO 8.3 [Ref. 11, pp. 3-5]. The amount of fine-grained materials (silt, clay, and colloids) in the solid portion of background samples for which analysis is available ranged from 7.6% to 64.9%, and the amount of fine-grained materials in the solid portion of the release samples ranged from 10.6% to 61% [Ref. 11, pp. 1, 8-9, 11-13, 15-16, 19-20, 22-25, 28].

Due to these similarities (i.e., same time frames, sampling and analytical methods, and sampling depths; similar ranges of percent solids, TOC, and grain-size) among the background and release samples, the background and release analytical results are considered to be comparable. The background and observed release concentrations for sediment samples are presented on the following pages.

Hazardous Substances Released:

Mercury

Note: Mercury was detected in the majority of sediment samples collected downstream of the Troy Chemical facility during the October 2012 EPA sampling event; concentrations documenting an observed release are presented in Table 3 [Figure 3; Ref. 7, pp. 68-76; 8, pp. 76-82; 9, pp. 75-83; 10, pp. 57-62]. Other hazardous substances, including volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCBs), and additional inorganic constituents, were detected at significant concentrations in sediment or surface water samples collected downstream of the Troy Chemical facility [Figure 3; Ref. 5, pp. 9-18; 6, pp. 3-14; 7, pp. 62-77; 8, pp. 66-82; 9, pp. 67-83; 10, pp. 50-62; 12, pp. 28-217; 13, pp. 25-112; 14, pp. 30-249, 288-382; 15, pp. 28-125]. Some of these substances might be attributable to historical releases from the facility, but they are not as uniquely connected to facility operations and there are other possible sources of these contaminants [Ref. 38, pp. 3-4, 35-42]; therefore, they are not included in scoring the site.

Background and Observed Release Concentrations
Sediment Samples, October 2012

TABLE 2. BACKGROUND CONCENTRATIONS *										
Field Sample ID	**PC-SD05A**		**PC-SD05C ****		**PC-SD05B**		**PC-SD08A**		**PC-SD08B**	
Inorganic CLP No.	MBAKW9		MBAKX1		MBAKX0		MBAKX6		MBAKX7	
Date	10/17/2012		10/17/2012		10/17/2012		10/17/2012		10/17/2012	
Depth (inches)	0 - 6		0 - 6		12 - 18		0 - 6		12 – 18	
% Solids	68.6		65.9		75.0		33.9		53.2	
% Moisture	31.4		34.1		25.0		66.1		46.8	
TOC (mg/kg)	30,000		18,000 j		27,000		94,000 j		130,000 j	
Total Fines (%Silt + %Clay/Colloids)	7.6		15.7		10.4		No analysis		42.2 j	
Reference(s)	Ref. 5, p. 11; 6, pp. 8, 29; 11, p. 8		Ref. 5, p. 11; 6, pp. 8, 29; 11, p. 9		Ref. 5, p. 11; 6, pp. 9, 29; 11, p. 9		Ref. 5, p. 12; 6, pp. 9, 29; 11, pp. 1, 11		Ref. 5, p. 12; 6, pp. 9, 29; 11, p. 11	
	Result	RDL	Result	RDL	Result	RDL	Result	RDL	Result	RDL
Mercury (mg/kg)	1.9	0.13	4.0	0.3	2.6	0.24	59.4 J (108.70)	5.4	41.1	3.5
Reference(s)	Ref. 7, pp. 26, 71		Ref. 7, pp. 30, 73		Ref. 7, pp. 28, 72		Ref. 7, pp. 5, 35, 75; 16, pp. 1-8, 18		Ref. 7, pp. 37, 75	

- mg/kg – Milligrams per kilogram
- j – The identification of the analyte is acceptable; the reported value is an estimate [Ref. 11, p. 1].
- RDL – Reporting detection limit. RDLs represent the increase over Quantitation Limits based on factors such as sample characteristics and dilution to enable quantification of target analytes [Ref. 7, pp. 71-73, 75]. Therefore, the RDL for each result is considered to equate to sample quantitation limit (SQL), which is defined in the HRS as the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (for example, dilution, concentration) [Ref. 1, Sections 1.1 and 2.3].
- J – This flag indicates that the result qualified as estimated; direction of bias is unknown [Ref. 7, pp. 2, 5]. These mercury results have been adjusted according to the EPA fact sheet "*Using Qualified Data to Document an Observed Release and Observed Contamination*"; adjusted values are shown in parentheses [Ref. 16, pp. 1-8, 18].

* Maximum background values (*italicized*) were used for determination of observed release.
** PC-SD05A and PC-SD05C were field duplicate samples from the same location and depth [Ref. 5, p. 11; 6, p. 8].

Background and Observed Release Concentrations
Sediment Samples, October 2012 (continued)

TABLE 2. BACKGROUND CONCENTRATIONS * (continued)												
Field Sample ID	**PC-SD09A**		**PC-SD09B**		**PC-SD06A**		**PC-SD06B**		**PC-SD27A**		**PC-SD27B**	
Inorganic CLP No.	MBAKX8		MBAKX9		MBAKX2		MBAKX3		MBAL17		MBAL18	
Date	10/17/2012		10/17/2012		10/18/2012		10/18/2012		10/18/2012		10/18/2012	
Depth (inches)	0 – 6		12 - 18		0 - 6		12 – 18		0 - 6		12 - 18	
% Solids	33.3		47.0		42.8		47.5		34.0		49.6	
% Moisture	66.7		53.0		57.2		52.5		66.0		50.4	
TOC (mg/kg)	87,000 j		130,000 j		130,000 j		66,000		110,000		110,000	
Total Fines (%Silt + %Clay/Colloids)	No analysis		33.6 j		30.4		35.2		64.9		9.2	
Reference(s)	Ref. 5, p. 12; 6, pp. 9, 29; 11, pp. 1, 11		Ref. 5, p. 12; 6, pp. 9, 29; 11, pp. 11-12		Ref. 5, p. 14; 6, pp. 9, 37; 11, p. 12		Ref. 5, p. 14; 6, pp. 9, 37; 11, p. 13		Ref. 5, p. 14; 6, pp. 9, 37; 11, p. 15		Ref. 5, p. 14; 6, pp. 9, 37; 11, p. 16	
	Result	RDL	Result	RDL	Result	RDL	Result	RDL	Result	RDL	Result	RDL
Mercury (mg/kg)	*66.4 J (121.51)*	5.5	42.7 J (78.14)	4.1	3.1 J (5.67)	1.0	16.5 J (30.195)	1.9	28.7 J (52.52)	2.8	3.3 J (6.04)	0.2
Reference(s)	Ref. 7, pp. 5, 40, 76; 16, pp. 1-8, 18		Ref. 7, pp. 5, 42, 76; 16, pp. 1-8, 18		Ref. 8, pp. 5, 9, 76; 16, pp. 1-8, 18		Ref. 8, pp. 5, 12, 76; 16, pp. 1-8, 18		Ref. 8, pp. 5, 32, 82; 16, pp. 1-8, 18		Ref. 8, pp. 5, 34, 82; 16, pp. 1-8, 18	

- mg/kg – Milligrams per kilogram
- j – The identification of the analyte is acceptable; the reported value is an estimate [Ref. 11, p. 1].
- RDL – Reporting detection limit. RDLs represent the increase over Quantitation Limits based on factors such as sample characteristics and dilution to enable quantification of target analytes [Ref. 7, p. 76; 8, pp. 76, 82]. Therefore, the RDL for each result is considered to equate to SQL, which is defined in the HRS as the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (for example, dilution, concentration) [Ref. 1, Sections 1.1 and 2.3].
- J – This flag indicates that the result qualified as estimated; direction of bias is unknown [Ref. 7, pp. 2, 5; 8, pp. 2, 5]. These mercury results have been adjusted according to the EPA fact sheet "*Using Qualified Data to Document an Observed Release and Observed Contamination*"; adjusted values are shown in parentheses [Ref. 16, pp. 1-8, 18].

* Maximum background values (*italicized*) were used for determination of observed release.

Background and Observed Release Concentrations
Sediment Samples, October 2012 (continued)

TABLE 3. RELEASE CONCENTRATIONS *										
Field Sample ID	**PC-SD13B**		**PC-SD14A**		**PC-SD14B**		**PC-SD14C ****		**PC-SD17B**	
Inorganic CLP No.	MBAKY7		MBAKY8		MBAKY9		MBAKZ0		MBAKZ6	
Date	10/23/2012		10/23/2012		10/23/2012		10/23/2012		10/23/2012	
Depth (inches)	12 - 18		0 - 6		12 - 18		12 – 18		12 - 14	
% Solids	32.6		31.1		33.4		33.3		41.1	
% Moisture	67.4		68.9		66.6		66.7		58.9	
TOC (mg/kg)	120,000		77,000		110,000		97,000		100,000	
Total Fines (%Silt + %Clay/Colloids)	61 j		37.2 j		49		29		50.8	
Reference(s)	Ref. 5, p. 16; 6, pp. 10, 50; 11, p. 23		Ref. 5, p. 16; 6, pp. 10, 50; 11, p. 24		Ref. 5, p. 16; 6, pp. 10, 50; 11, p. 24		Ref. 5, p. 16; 6, pp. 10, 50; 11, p. 25		Ref. 5, pp. 16, 24; 6, pp. 10, 52; 11, p. 28	
	Result	RDL	Result	RDL	Result	RDL	Result	RDL	Result	RDL
Mercury (mg/kg)	924 J (504.92)	50.2	694 J (379.23)	42.3	1,290 J (704.92)	95.3	1,400 J (765.03)	90.1	855 J (467.21)	48.7
Reference(s)	Ref. 8, pp. 5, 29, 80; 16, pp. 8, 18		Ref. 8, pp. 5, 30, 81; 16, pp. 8, 18		Ref. 9, pp. 3-5, 10, 75; 16, pp. 8, 18		Ref. 9, pp. 3-5, 13, 76; 16, pp. 8, 18		Ref. 9, pp. 3-5, 24, 80; 16, pp. 8, 18	

- mg/kg – Milligrams per kilogram
- j – The identification of the analyte is acceptable; the reported value is an estimate [Ref. 11, p. 1].
- RDL – Reporting detection limit. RDLs represent the increase over Quantitation Limits based on factors such as sample characteristics and dilution to enable quantification of target analytes [Ref. 8, pp. 80-81; 9, pp. 75-76, 80]. Therefore, the RDL for each result is considered to equate to SQL, which is defined in the HRS as the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (for example, dilution, concentration) [Ref. 1, Sections 1.1 and 2.3].
- J – This flag indicates that the result qualified as estimated; direction of bias is unknown [Ref. 8, pp. 2, 5; 9, pp. 2, 5]. These mercury results have been adjusted according to the EPA fact sheet "*Using Qualified Data to Document an Observed Release and Observed Contamination*"; adjusted values are shown in parentheses [Ref. 16, pp. 1-8, 18].

* Maximum background values (*italicized*) were used for determination of observed release.
** PC-SD14B and PC-SD14C were field duplicate samples from the same location and depth [Ref. 5, p. 16; 6, p. 10].

Background and Observed Release Concentrations
Sediment Samples, October 2012 (continued)

TABLE 3. RELEASE CONCENTRATIONS * (continued)						
Field Sample ID	**PC-SD23A**		**PC-SD23B**		**PC-SD25B**	
Inorganic CLP No.	MBAL07		MBAL08		MBAL12	
Date	10/25/2012		10/25/2012		10/25/2012	
Depth (inches)	0 - 6		12 - 18		12 - 18	
% Solids	47.6		50.3		60.5	
% Moisture	52.4		49.7		39.5	
TOC (mg/kg)	84,000		73,000		15,000	
Total Fines (%Silt + %Clay/Colloids)	41.4		25.2		10.6	
Reference(s)	Ref. 5, p. 18; 6, pp. 11, 64; 11, p. 19		Ref. 5, p. 18; 6, pp. 11, 64; 11, p. 20		Ref. 5, p. 18; 6, pp. 11, 64; 11, p. 22	
	Result	RDL	Result	RDL	Result	RDL
Mercury (mg/kg)	737 J (402.73)	80.8	1,130	69.8	1,770	99.2
Reference(s)	Ref. 10, pp. 5, 16, 58; 16, pp. 1-8, 18		Ref. 10, pp. 19, 58		Ref. 10, pp. 27, 61	

- mg/kg – Milligrams per kilogram
- RDL – Reporting detection limit. RDLs represent the increase over Quantitation Limits based on factors such as sample characteristics and dilution to enable quantification of target analytes [Ref. 10, pp. 58, 61]. Therefore, the RDL for each result is considered to equate to SQL, which is defined in the HRS as the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (for example, dilution, concentration) [Ref. 1, Sections 1.1 and 2.3].
- J – This flag indicates that the result qualified as estimated; direction of bias is unknown [Ref. 10, pp. 2, 5]. These mercury results have been adjusted according to the EPA fact sheet "*Using Qualified Data to Document an Observed Release and Observed Contamination*"; adjusted values are shown in parentheses [Ref. 16, pp. 1-8, 18].

* Maximum background values (*italicized*) were used for determination of observed release.

Attribution

For the Pierson's Creek site, the source under consideration is the historical disposal of mercury-containing wastewaters into Pierson's Creek. The Troy Chemical facility manufactured mercury compounds from 1956 or 1957 until 1987 [Ref. 17, p. 4, 22, 57; 18, p. 2; 19, pp. 12-14; 20, p. 14; 28, p. 2; 29, pp. 2-3, 6-7; 30, pp. 1-2; 37, p. 1; 38, pp. 13, 29-30]. The facility discharged its mercury-bearing wastewater directly into Pierson's Creek until 1976, and there were additional discharges, leaks, and spills to Pierson's Creek after the facility connected to the PVSC sewer system in 1976 [Ref. 17, pp. 6, 8, 14-15; 18, pp. 5, 12-21; 30, p. 3; 32, pp. 1-9; 34, p. 2]. Troy Chemical has considered surface water and sediment conditions in Pierson's Creek and its unnamed tributary to be the principal environmental concerns associated with the site, and the company has reported that its former operations have contributed to the mercury detected in sediment within the concrete ditch and downstream areas of Pierson's Creek [Ref. 19, p. 11; 38, pp. 59-60, 84; 39, pp. 9, 16, 29].

Previous investigations by Troy Chemical, NJDEP, and EPA have indicated significant increases in sediment mercury concentrations at and downstream of the facility compared to upstream sediment concentrations, as recently as 2010 [Ref. 18, pp. 12-20; 19, p. 147; 30, pp. 4-9; 33, pp. 1-2; 37, p. 12; 38, p. 84; 39, pp. 29, 32]. Some of the sediment and surface water sampling events were conducted when the creek originated north of the Troy Chemical facility and flowed through the concrete channel on the property [Ref. 18, pp. 12-20]. In July 1979, EPA collected a sediment sample from Pierson's Creek just downstream of the mercury wastewater treatment system and reported a mercury concentration of 22,400 mg/kg, compared to upstream concentrations of 140 and 191 mg/kg; mercury was also detected above background in samples collected downstream of the facility [Ref. 30, pp. 4-7]. That sampling event occurred shortly after one of Troy Chemical's products (Troysan PMA) was found dumped on the upstream property, including alongside and within the Pierson's Creek streambed, which could have been responsible for upstream mercury contributions [Ref. 40, pp. 1-4; 41, pp. 1-3; 42, p. 1; 43, pp. 4, 24]. The observed release to Pierson's Creek and associated wetland areas is supported by the October 2012 EPA sampling data.

Although there are other possible sites in the vicinity of the Troy Chemical facility, the release samples show concentrations of mercury, a site-attributable contaminant, that are significantly above the concentrations in background samples [Figure 3]. Background sediment samples were collected from unnamed tributary streams that are also located in this heavily-industrialized section of Newark [Figure 3]. In all cases, maximum background concentrations were used for comparison to account for other possible contributors of mercury contamination, and release concentrations were significantly above these maximum background levels [see Tables 2 and 3]. Mercury was detected above background at other sediment sample locations downstream of the Troy Chemical facility. [Figure 3; Ref. 7, pp. 68-76; 8, pp. 76-82; 9, pp. 75-83; 10, pp. 57-62]. The increase in concentrations is located immediately downstream of the Troy Chemical facility, beginning at the PPE [Figure 3].

In 2010, Troy Chemical assessed other point source and non-point source contributions to sediment contamination, including industrial properties in the immediate vicinity of the Troy Chemical facility and Pierson's Creek: Former Red Star property to the immediate south, Globe Metals property to the immediate east, Former Albert Steel Drum/Prentiss Drug Co. (ASD/PDC) property to the immediate north, and Former Engelhard property to the south of Former Red Star [Ref. 38, pp. 3-4, 35-42]. None of these properties were identified as a contributor of the sediment mercury contamination [Ref. 38, pp. 35-42]. Based on the assessment, Troy concluded that the historical information and available sediment data indicate at least a partial contribution of mercury from Troy Chemical operations [Ref. 38, pp. 3-4].

Based on these considerations, the observed release to surface water is considered to be at least partially attributable to the Pierson's Creek site.

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Observed Release Factor Value: 550

4.1.3.2 Human Food Chain Threat - Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

TABLE 4. TOXICITY/PERSISTENCE/BIOACCUMULATION						
Hazardous Substance	**Source Number**	**Toxicity Factor Value**	**River Persistence Factor Value***	**Food Chain Bioaccumulation Factor Value****	**Toxicity/Persistence/ Bioaccumulation Factor Value (HRS Table 4-16)**	**Ref. 2 Page**
Mercury	1	10,000	1	50,000	5×10^8	BI-8

* The predominant water category between the PPE and the documented fishery in Upper New York Bay is Coastal tidal waters; therefore, the river persistence factor value for mercury is assigned [Ref. 1, Sections 4.0.2, 4.1.2.2.1.2 and 4.1.3.2.1.2; 2, p. BI-8].

** The documented fishery in Upper New York Bay is a saltwater fishery; therefore, the bioaccumulation factor value for salt water is assigned [Ref. 1, Section 4.1.3.2.1.3; 2, p. BI-8; 53, pp. 10, 29-30; 55, p. 1].

4.1.3.2.2 Hazardous Waste Quantity

TABLE 5. HAZARDOUS WASTE QUANTITY		
Source Number	**Source Hazardous Waste Quantity (HWQ) Value (HRS Section 2.4.2.1.5)**	**Is source hazardous constituent quantity data complete? (yes/no)**
1	>0	No
Sum of Values:	1 (rounded to nearest integer as specified in HRS Section 2.4.2.2)	

The hazardous constituent quantity for the source has not been adequately determined. The hazardous waste quantity is undetermined, but greater than zero. According to Section 2.4.2.2 of the HRS (Ref. 1, p. 51592), if any target for the migration pathway under consideration is subject to Level I (or Level II) concentrations, assign either the value from Table 2-6 (Ref. 1, p. 51591) or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway. Because Level II concentrations are present in an HRS eligible wetland, a hazardous waste quantity factor value of 100 is assigned.

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Table 2-6, p. 51591)

4.1.3.2.3 Waste Characteristics Factor Category Value

Mercury associated with Source 1, which has a surface water pathway containment factor value greater than 0 for the watershed, corresponds to a toxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000, as shown above [Ref. 1, Section 4.1.3.2.1.4; 2, p. BI-8].

(Toxicity/Persistence Factor Value) x (Hazardous Waste Quantity Factor Value) =
$10{,}000 \times 100 = 1 \times 10^6$
[Ref. 1, Section 4.1.3.2.3]

(Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value) x
(Bioaccumulation Potential Factor Value) = $(1 \times 10^6) \times (50{,}000) = 5 \times 10^{10}$ subject to a maximum of 1×10^{12}
[Ref. 1, Section 4.1.3.2.3]

The value of 5×10^{10} corresponds to a waste characteristics factor category value of 320 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

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Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 100
Waste Characteristics Factor Category Value: 320

4.1.3.3 Human Food Chain Threat - Targets

The New York-New Jersey Harbor Estuary within the 15-mile TDL, including the Newark Bay Complex and other water bodies, is used for consumption fishing [Ref. 49, p. 1; 50, pp. 9, 14-16; 51,pp. 5-7]. There are fishing access locations to Newark Bay, Arthur Kill, Kill Van Kull, Upper New York Bay, The Narrows, and the tidal rivers that flow into the harbor [Figure 4; Ref. 52, pp. 18-21; 53, pp. 13-14, 29-30; 54, p. 15]. One example of a specific location within the TDL where consumption fishing has been reported is the 69th Street American Veterans Memorial Pier, located in Brooklyn along the eastern edge of Upper New York Bay [Figure 4; Ref. 53, pp. 29-30; 54, pp. 15, 22, 29; 55, p. 1]. The available documentation does not demonstrate that the fishery is located within the zone of contamination; therefore, the target fishery is evaluated for potential contamination [Figures 3, 4; Ref. 1, Section 4.1.3.3; Ref. 50, p. 14].

Samples for Observed Release/Level I/Level II Concentrations

The sediment concentrations meet the criteria for Level II concentrations because there are no media-specific benchmarks for sediment [Ref. 1, Sections 2.5 and 4.1.4.3.1; 2, p. BII-8]:

TABLE 6. SAMPLES FOR OBSERVED RELEASE

Sample ID	Distance from PPE	Hazardous Substance	Concentration (mg/kg)	Reference(s)
PC-SD25B	0 feet	Mercury	1,770	Figure 3; Ref. 10, pp. 27, 61
PC-SD23A	180 feet	Mercury	737 J (402.73)	Figure 3; Ref. 10, pp. 5, 16, 58; 16, pp. 1-8, 18
PC-SD23B	180 feet	Mercury	1,130	Figure 3; Ref. 10, pp. 19, 58
PC-SD17B	700 feet	Mercury	855 J (467.21)	Figure 3; Ref. 9, pp. 3-5, 24, 80; 16, pp. 8, 18
PC-SD14A	1,150 feet	Mercury	694 J (379.23)	Figure 3; Ref. 8, pp. 5, 30, 81; 16, pp. 8, 18
PC-SD14B	1,150 feet	Mercury	1,290 J (704.92)	Figure 3; Ref. 9, pp. 3-5, 10, 75; 16, pp. 8, 18
PC-SD14C	1,150 feet	Mercury	1,400 J (765.03)	Figure 3; Ref. 9, pp. 3-5, 13, 76; 16, pp. 8, 18
PC-SD13B	1,300 feet	Mercury	924 J (504.92)	Figure 3; Ref. 8, pp. 5, 29, 80; 16, pp. 8, 18

J – This flag indicates that the result qualified as estimated; direction of bias is unknown [Ref. 8, pp. 1-5; 9, pp. 1-5; 10, pp. 1-5]. These results have been adjusted according to the EPA fact sheet "*Using Qualified Data to Document an Observed Release and Observed Contamination*"; adjusted values are shown in parentheses [Ref. 16, pp. 1-8, 18].

4.1.3.3.1 Food Chain Individual

There is an observed release to surface water of at least one hazardous substance (mercury) with a bioaccumulation potential factor value of 500 or greater and there is a fishery present within the 15-mile TDL [see Sections 4.1.2.1.1, 4.1.3.2.1, and 4.1.3.3]. Therefore, a food chain individual factor value of 20 is assigned [Ref. 1, Section 4.1.3.3.1].

Sample ID:	PC-SD25B, PC-SD23A. PC-SD23B, PC-SD17B, PC-SD14A, PC-SD14B, PC-SD14C, PC-SD13B
Hazardous Substance:	Mercury
Bioaccumulation Potential:	50,000
References:	See Section 4.1.2.1.1

TABLE 7. FISHERIES

Identity of Fishery	Type of Surface Water Body	Dilution Weight	Reference(s)
Upper New York Bay	Coastal tidal waters	0.0001	Figure 4; Ref. 1, Table 4-13; 49, p. 1; 50, pp. 9-10, 14-16; 51, pp. 6-7; 53, pp. 29-30; 54, pp. 15, 22; 55, p. 1

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Food Chain Individual Factor Value: 20

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

The Level I concentrations factor value is 0 because there are no fisheries subject to Level I concentrations [Ref. 1, Section 4.1.3.3.2.1].

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Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

The Level II concentrations factor value is 0 because there are no fisheries subject to Level II concentrations [Ref. 1, Section 4.1.3.3.2.2].

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Level II Concentrations Factor Value: 0

4.1.3.3.2.3 Potential Human Food Chain Contamination

People catch fish for consumption from the New York-New Jersey Harbor Estuary within the 15-mile TDL of the site [Figure 4; Ref. 49, p. 1; 50, pp. 9-10, 14-16; 51, pp. 6-7; 54, pp. 4, 15]. One such specific location where consumption fishing has been reported is the 69th Street American Veterans Memorial Pier, located in Brooklyn along the eastern edge of Upper New York Bay [Ref. 53, pp. 29-30; 54, pp. 15, 22, 29; 55, p. 1]. The fish consumption rate for the downstream fishery is not documented but known to be greater than zero, so the fishery is assigned to the category "Greater than 0 to 100 pounds per year," which corresponds to the assigned human food chain population value of 0.03 in Table 4-18 of the HRS [Ref. 1, Section 4.1.3.3.2; Ref. 52, pp. 18-21; 53, pp. 13-14, 29-30; 54, p. 15, 22, 29; 55, p. 1]. The available documentation from the October 2012 EPA sampling event indicates that the fishery is located within the TDL but does not demonstrate precisely that the fishery is located within the zone of contamination associated with the Pierson's Creek site; therefore, the target fishery is evaluated for potential human food chain contamination [Figures 2, 4; Ref. 1, Section 4.1.3.3; Ref. 50, p. 14; 54, p. 15; 55, p. 1]. Previous studies have shown that mercury affects the sediments of Newark Bay, but those data are not considered here for evaluation [Ref. 57, pp. 28-39].

TABLE 8. POTENTIAL HUMAN FOOD CHAIN CONTAMINATION

Identity of Fishery	Annual Production (Pounds)	Type of Surface Water Body (Table 4-13)	Average Annual Flow (cfs)	Population Value (P_i) (Table 4-18)	Dilution Weight (D_i) (Table 4-13)	$P_i \times D_i$
NY-NJ Harbor Estuary	Greater than 0	Coastal tidal waters	N/A	0.03	0.0001	0.000003

Sum of $P_i \times D_i$: 0.000003
(Sum of $P_i \times D_i$)/10: 0.0000003

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Potential Human Food Chain Contamination Factor Value: 0.0000003

4.1.4.2 Environmental Threat - Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

TABLE 9. ECOTOXICITY/PERSISTENCE/BIOACCUMULATION						
Hazardous Substance	**Source Number**	**Ecotoxicity Factor Value**	**Persistence Factor Value ***	**Ecosystem Bioaccumulation Factor Value ****	**Ecotoxicity/Persistence/ Bioaccumulation Factor Value (HRS Table 4-21)**	**Ref. 2 Page**
Mercury	1	10,000	1	50,000	5×10^8	BI-8

* The predominant water category between the PPE and the nearest sensitive environment (i.e., wetlands along Pierson's Creek) is River; therefore, the river persistence factor value is assigned [Ref. 1, Sections 4.1.2.2.1.2 and 4.1.4.2.1.2; 2, p. BI-8].

** The sensitive environments being evaluated are in fresh water (Pierson's Creek), brackish water (NY-NJ Harbor Estuary – Newark Bay), and salt water (NY-NJ Harbor Estuary – Arthur Kill, Kill Van Kull, Upper New York Bay) [Figure 4; Ref. 38, pp. 14-15, 84, 90; 53, pp. 10, 14-15, 29-30; 56, p. 5]. The environment bioaccumulation factor value for both fresh and salt water is 50,000, which is assigned as the ecosystem bioaccumulation factor value [Ref. 1, Section 4.1.3.2.1.3 and 4.1.4.2.1.3; 2, p. BI-8]

4.1.4.2.2 Hazardous Waste Quantity

TABLE 10. HAZARDOUS WASTE QUANTITY		
Source Number	**Source Hazardous Waste Quantity (HWQ) Value (HRS Section 2.4.2.1.5)**	**Is source hazardous constituent quantity data complete? (yes/no)**
1	>0	No
Sum of Values:	1 (rounded to nearest integer as specified in HRS Section 2.4.2.2)	

The hazardous constituent quantity for the source has not been adequately determined. The hazardous waste quantity is undetermined, but greater than zero. According to Section 2.4.2.2 of the HRS (Ref. 1, p. 51592), if any target for the migration pathway under consideration is subject to Level I (or Level II) concentrations, assign either the value from Table 2-6 (Ref. 1, p. 51591) or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway. Because Level II concentrations are present in an HRS eligible wetland, a hazardous waste quantity factor value of 100 is assigned.

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Table 2-6, p. 51591)

4.1.4.2.3 Waste Characteristics Factor Category Value

Mercury associated with Source 1, which has a surface water pathway containment factor value greater than 0 for the watershed, corresponds to an ecotoxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000, as shown above [Ref. 1, Section 4.1.3.2.1.4; 2, p. BI-8].

(Ecotoxicity/persistence factor value) x (hazardous waste quantity factor value) =
$10{,}000 \times 100 = 1 \times 10^6$
[Ref. 1, Section 4.1.4.2.3]

(Ecotoxicity/persistence factor value x hazardous waste quantity factor value) x (bioaccumulation potential factor value) = $(1 \times 10^6) \times (50{,}000) = 5 \times 10^{10}$ subject to a maximum of 1×10^{12}
[Ref. 1, Section 4.1.4.2.3]

The value of 5×10^{10} corresponds to a waste characteristics factor category value of 320 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 100
Waste Characteristics Factor Category Value: 320

4.1.4.3 Environmental Threat - Targets

The zone of contamination (i.e., area where observed release by chemical analysis is documented) along the surface water migration pathway downstream of the site source extends from the PPE at sample location PC-SD25B south to sample location PC-SD13B approximately 0.25 mile downstream [Figure 3; see Section 4.1.2.1.1]. There are HRS-eligible wetlands along the zone of contamination, and the total wetland frontage considered as subject to actual contamination is approximately 0.15 mile [Figures 2, 3; Ref. 1, Section 4.1.4.3.1; 5, pp. 43-62]. There are no media-specific benchmarks for sediment, so the target wetlands are subject to Level II concentrations [Ref. 1, Sections 2.5 and 4.1.4.3; 2, pp. BII-8].

Newark Bay is part of the New York-New Jersey Harbor Estuary, which is a sensitive area identified under the National Estuary Program [Ref. 51, pp. 1-10]. The available documentation does not demonstrate that the estuary is located within the zone of contamination; therefore, this sensitive environment is evaluated as subject to potential contamination [Figures 2, 4; Ref. 1, Sections 4.1.1.2 and 4.1.4.3].

Samples for Observed Release/Level I/Level II Concentrations

The sediment concentrations meet the criteria for Level II concentrations because there are no media-specific benchmarks for sediment [Ref. 1, Sections 2.5 and 4.1.4.3.1; 2, p. BII-8]:

TABLE 11. SAMPLES FOR OBSERVED RELEASE

Sample ID	Distance from PPE	Hazardous Substance	Concentration (mg/kg)	Reference(s)
PC-SD25B	0 feet	Mercury	1,770	Figure 3; Ref. 10, pp. 27, 61
PC-SD23A	180 feet	Mercury	737 J (402.73)	Figure 3; Ref. 10, pp. 5, 16, 58; 16, pp. 1-8, 18
PC-SD23B	180 feet	Mercury	1,130	Figure 3; Ref. 10, pp. 19, 58
PC-SD17B	700 feet	Mercury	855 J (467.21)	Figure 3; Ref. 9, pp. 3-5, 24, 80; 16, pp. 8, 18
PC-SD14A	1,150 feet	Mercury	694 J (379.23)	Figure 3; Ref. 8, pp. 5, 30, 81; 16, pp. 8, 18
PC-SD14B	1,150 feet	Mercury	1,290 J (704.92)	Figure 3; Ref. 9, pp. 3-5, 10, 75; 16, pp. 8, 18
PC-SD14C	1,150 feet	Mercury	1,400 J (765.03)	Figure 3; Ref. 9, pp. 3-5, 13, 76; 16, pp. 8, 18
PC-SD13B	1,300 feet	Mercury	924 J (504.92)	Figure 3; Ref. 8, pp. 5, 29, 80; 16, pp. 8, 18

J – This flag indicates that the result qualified as estimated; direction of bias is unknown [Ref. 8, pp. 1-5; 9, pp. 1-5; 10, pp. 1-5]. These results have been adjusted according to the EPA fact sheet "*Using Qualified Data to Document an Observed Release and Observed Contamination*"; adjusted values are shown in parentheses [Ref. 16, pp. 1-8, 18].

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

The Level I concentrations factor value is 0 because there are no sensitive environments subject to Level I concentrations [Ref. 1, Section 4.1.4.3.1.1].

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Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

There are no media-specific benchmarks for sediment, so the target wetlands are subject to Level II concentrations [Figures 3, 4; Ref. 1, Sections 2.5 and 4.1.4.3; 2, p. BII-8].

Sensitive Environments

There are currently no known sensitive environments other than wetlands that are considered as subject to Level II concentrations [Figures 3, 4; Ref. 1, Section 4.1.4.3].

Wetlands

There are HRS-eligible wetlands along the zone of contamination, and the total wetland frontage subject to actual contamination is approximately 0.15 mile [Figure 3; Ref. 1, Section 4.1.4.3.1; Ref. 5, pp. 43-62].

TABLE 12. LEVEL II CONCENTRATIONS – WETLANDS

Wetland	Wetland Frontage	Wetlands Rating Value (HRS Table 4-24)	Reference
Pierson's Creek	0.15 mile	25	Figures 2, 3; Ref. 5, pp. 43-62

Wetland Value: 25

Sum of Sensitive Environments Value + Wetland Value: 25

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Level II Concentrations Factor Value: 25

4.1.4.3.1.3 Potential Contamination

Sensitive Environments

Newark Bay is part of the New York-New Jersey Harbor Estuary, which is a sensitive area identified under the National Estuary Program [Ref. 51, pp. 1-10].

TABLE 13. POTENTIAL CONTAMINATION – SENSITIVE ENVIRONMENTS			
Type of Surface Water Body	**Sensitive Environment**	**References**	**Sensitive Environment Rating Value (HRS Table 4-23)**
Coastal Tidal Waters	NY-NJ Harbor Estuary (sensitive area identified under National Estuary Program)	Figure 4; Ref. 51, pp. 1-10	100

Sum of Sensitive Environment Values (S_j) = 100 [Figure 4; Ref. 1, Table 4-23; 51, pp. 1-10]

Wetlands

Although the most recent National Wetlands Inventory (NWI) information available from U.S. Fish and Wildlife Service (USFWS) indicates that there are approximately 29 miles of wetland frontage within the TDL [Figure 4; Ref. 48, pp. 1-2], the wetland frontage value (W_j) is not scored.

Potential Contamination Factor Value (SP)

TABLE 14. POTENTIAL CONTAMINATION FACTOR VALUE				
Type of Surface Water Body	**Dilution Weight (D_j) from HRS Table 4-13**	**Sum of Sensitive Environment Values (S_j)**	**Wetland Frontage Value (W_j)**	**Potential Contamination Factor Value ($[W_j + S_j]*D_j) / 10$**
Coastal Tidal Waters (NY-NJ Harbor Estuary)	0.0001	100	Not scored	0.001

The potential contamination factor value is 0.001 [Figure 4; Ref. 1, Tables 4-13, 4-23, and 4-24].

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Potential Contamination Factor Value: 0.001